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Manipulating Nature—Weeds

Weeds have always plagued us. The same weeds that harassed our ancestors still trouble us today—along with some new ones.

Viking sea captains brought weeds with them when they first visited North America. Christopher Columbus brought weeds when he discovered the West Indies. And the Spaniards brought weeds when they established the first settlement in St. Augustine, FL, in 1565.

Weeds are documented as among the most serious obstacles to producing food in the American Colonies; they may have played a role in the failure of Roanoke Island, NC.

The first successful English settlement in this country was Jamestown, VA, in 1607; 2 years later, slaves were brought to Jamestown to help grow tobacco and control weeds.

The first methods of weed control involved human, livestock, and mechanical energy. Common salt was probably the first herbicide used to control weeds. Copper sulfate was introduced about 1896 to control weeds in wheat.

More than 90 percent of current weed control technology has been developed since 1940—much of it since 1960. Cultural, other ecological, biological, and chemical control methods are practiced on more than 369 million acres of harvested crops alone each year.

But, we must do more.

Weed control is a major environmental manipulation. Today's world population cannot survive in a natural or static environment. Our standard of living, and, indeed, our surival depend on this environmental manipulation.

We must develop an ecological balance that provides for maximum food production as well as protecting our natural resources and environment.

Plant diseases, weeds, nematodes, and insects threaten not only food and fiber, but our health and welfare as well.

There are about 30,000 species of weeds in the world. Most cultivated crops compete with about 200 weed species and between 10 and 50 different weed species infest each of our major food crops each year.

We must develop a better understanding of the ecology, phenology, physiology, biochemistry, and botanical aspects of weeds. This knowledge would be most helpful in perfecting efficient farm approaches for weed control. Only when agricultural research provides the answers, will we understand how to manipulate nature to the fullest to control weeds and protect humans, wildlife, and the environment.—*M.M.M.*

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COVER: Cotton bollworm, *Heliothis zea*, penetrates a soybean pod to feed on the seed. Scientists are developing resistant soybean strains to curb this pest's ravages (1176X1500-19). Article begins on page 3.

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Bob Bergland, Secretary
U.S. Department of Agriculture

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Outcome of leaf-feeding tests is inspected by Dr. Beland. The healthy 15-day-old larva of Heliothis zea *on the left was raised on the leaves of a non-resistant "control" soybean strain; by contrast, stunted* Heliothis zea *larva of the same age displays the antibiotic effect of the resistant soybean strain (1176X1497–6).*

No Free Lunch here... Toward Natural Resistance

THE BOLLWORM, *Heliothis zea* (Boddie), and its hungry fellow villain, the tobacco budworm, *Heliothis virescens* (Fabricius), are having a "field" day, a relentless march through soybean fields. During 1972 collections from soybean fields in the Central Delta area of Mississippi revealed 75 percent tobacco budworm.

And *Heliothis* are not declining.

Today the search for insect-resistant soybean cultivars is a major part of pest-management systems. The possibility that insect-resistant soybeans could be developed began with the discovery of high levels of resistance to the Mexican bean beetle in plant introductions (PI) of soybeans PI 171451, PI 227687, and PI 229358 in 1969. It was also reported that these same PI's were resistent to the bean leaf beetle, striped blister beetle, and bollworm in field cage studies.

From this vantage point, antibiosis—or resistance—to bollworm larvae in PI 227687 also seemed probable.

Entomologists Jimmy H. Hatchett and Gary L. Beland and agronomist Edgar E. Hartwig, U.S. Delta States Agricultural Research Center (P.O. Box 225, Stoneville, MS 38776) have successfully demonstrated that soybean cultivars with leaf-feeding resistance may be useful sources of resistance to *Heliothis* species.

Leaf-feeding tests were conducted in the laboratory to determine whether plant introduction PI's 171451, 227687, and 229358 exhibit resistance to bollworm and tobacco budworm larvae. Five commercial cultivars—Forrest, Tracy Davis, Lee 68 and Bragg—that are adapted to southern United States and have no known source of insect resistance were included as susceptible checks.

Seeds of each entry were germinated in plastic trays containing vermiculite, a highly water-absorbent material; 45 plants were established for each entry per test and were grown in a greenhouse at 26° to 33° C. A photoperiod of 15 hours' light was used to maintain plants in the vegetative stage. Supplemental

Above: Biological research technician J. Robert Shaw waters insect-resistant soybean strains grown in greenhouses at the U.S. Delta States Agricultural Research Center. Leaves from these plants will be used in feeding tests (1176X1501–10). Below: Biological research technician Velma Williamson infests soybean screening material with 1st instar Heliothis *larvae. Larvae will be inspected daily for mortality, and weighed after 16 days (1176X1499–10).*

light was given to extend the light period beyond natural daylight. Plants were fertilized 2 weeks after transplanting.

Heliothis larvae used in the tests were obtained from laboratory colonies at Stoneville. Two feeding tests were conducted for each insect. Tests were begun when plants were 6 to 8 weeks old and in the 7- to 9-trifoliolate (3-leaf) stage. After 3 days, larvae were thinned to one per cup. All larvae were observed daily for mortality, and tobacco budworm larvae were weighed at 14 days and bollworm at 16 days after infestation. When larvae reached the prepupal stage, they were transferred to cups containing moistened sterile vermiculite and allowed to pupate.

Criteria for resistance were larval mortality, larval and pupal weights, and length of larval stage.

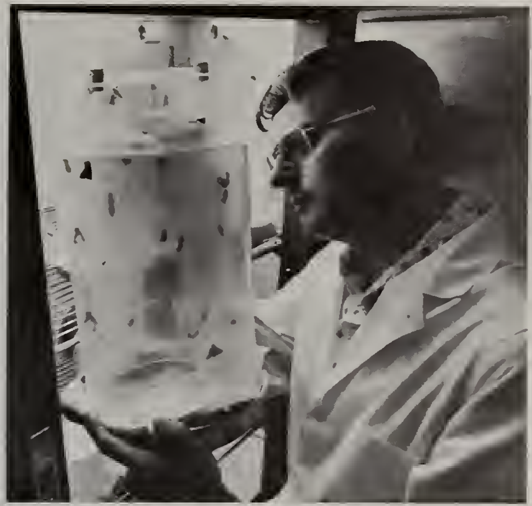
The leaf-feeding studies demonstrated that PI's 171451, 227687, and 229358 have strong antibiotic effects on immature stages of bollworm and tobacco budworm. On the basis of percentage larval mortality PI 171451 and PI 229358 were more resistant to the bollworm than to tobacco budworm; PI 227687 was equally resistant to both species and showed a higher level of resistance than PI's 171451 and 229358. Among larvae fed on the PI's, mortality was greater than among larvae fed on the commercial cultivars, weight gains of larvae were reduced, and time to pupation was greater.

"The fact that none of the larvae survived on PI 227687 suggests that the resistance of this PI may be genetically different from that of PI's 171451 and 229358," said Dr. Beland. "Although the susceptibility of the commercial cultivars varied between tests and insects, Forrest, Lee 68, and Davis were generally more susceptible than Bragg and Tracy to the bollworm and tobacco budworm."

Because bollworm and tobacco budworm larvae are primarily pod feeders, additional evaluations are needed to determine whether PI's 171451, 227687, and 229358 have pod-feeding resistance. However, Dr. Beland adds, in the Southern United States bollworms occasionally infest late-maturing soybeans before pods develop and may cause extensive foliar damage.

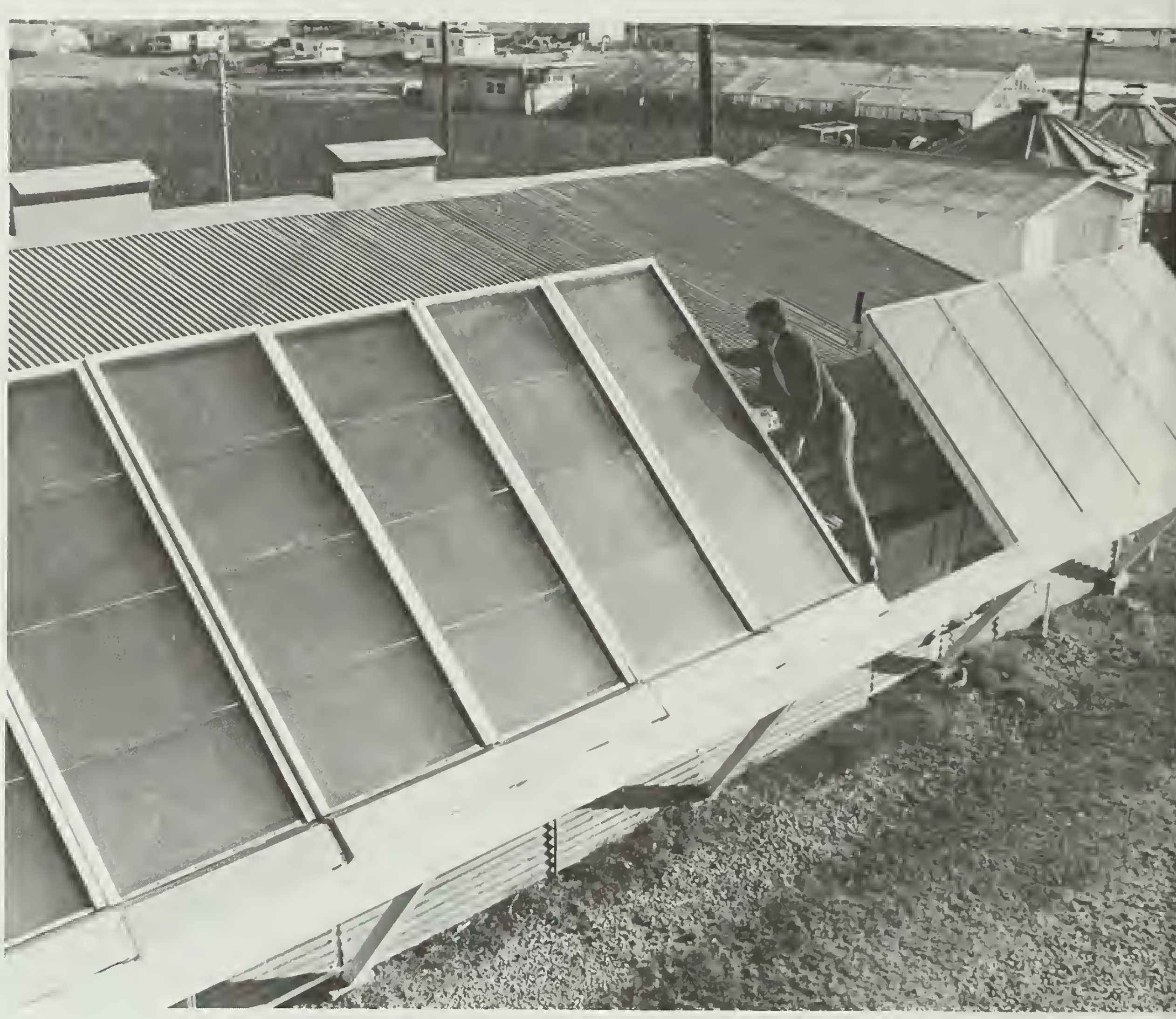
The scientists' observations of feeding behavior of larvae in the field have indicated that young larvae feed on leaves before attacking pods.

Concerned growers may take comfort—and profit—from soybean PI's newly evaluated for resistance.—*P.L.G.*



Dr. Beland observes Heliothis *moths used to produce larvae for leaf-feeding tests (1176X1499–34).*

Soybean harvest on the Mississippi Delta. Mississippi claims 5 million acres of the vast Delta which also covers part of Arkansas and Louisiana. In 1975 the rich alluvial Delta soil produced over 50 percent of Mississippi's total soybean harvest on plantings of 1.6 million acres. Soybeans are of increasing economic importance in Mississippi and other Southeastern States largely due to regionally adaptable varieties developed cooperatively by ARS and State researchers (1176X1501–16).



Research assistant Jerry H. Drott checks the pyranometer—an instrument that measures solar radiation—between the two types of solar collectors atop the poultry house. The collector in the foreground heats the ventilation air used in the house during daylight hours. The other collector heats water that is stored for heating the house at night (1076X1415–14A).

Raising broilers with less fuel

Bobby Bates, Engineering Technician, checks the flow of solar heated air used to warm the poultry growing area (1076X 1415–27A).

THE USE of special techniques plus solar energy can cut fuel costs for raising broilers by 90 percent.

The energy-saving techniques—insulation, controlled ventilation, and partial-house brooding—reduced fuel requirements by 70 percent in recent tests (South Central Poultry Research Laboratory, P.O. Box 5367, Mississippi State, MS 39762). A solar energy system developed at the laboratory further reduced the need for fuel by 20 percent.

ARS agricultural engineer F. N. Reece and animal scientist James W. Deaton partitioned off 15 percent of a rearing house, brooded the birds there for the first 2 weeks, and then released them into half of the house. After 4 weeks, the birds were released into the full house, a windowless structure 36

by 80 feet insulated with 3½ inches of glass fiber. The structure houses 3,600 chickens.

During the first week, the scientists maintained a temperature of 85°, 80° the second week, 75° the third week, and 70° during the fourth through eighth weeks.

These temperatures were maintained during December 1975 and January 1976, the coldest time of the year, by heat from solar collectors.

Total fuel consumption during the 8-week test was 8 gallons of liquified petroleum gas per 1,000 chickens. Most of this gas was burned by pilot lights for a backup conventional heating system held in readiness in case solar energy collectors were insufficient to maintain heat requirements.

Precision ventilation control was maintained at all times. In fact, ventilation had to be increased about three times over the basic rate during warm days to keep the temperature down.

To collect solar energy, the scientists used two types of flatplate solar collectors. One type of collector, consisting of 24 square feet exposed to the sun, heated the ventilation air directly while the sun was shining; six of these were used. The other type had 18 square feet of surface and heated water to store energy for use at night; five of these were used. The water was held in a 550-gallon tank, and the stored heat was transferred through an automobile radiator which the scientists had adapted.

In this experiment, no attempt was made to provide energy storage for periods of prolonged cloudy weather.

The technology for using solar energy in poultry production is not commercially available at this time, but the researchers believe that such technology can be developed and that it could practically eliminate the need for fossil fuel in the broiler-raising industry.—*B.D.C.*

New approach to disease control

JUST AS human soldiers require various degrees of training to fight the enemy, lymphocytes, a type of white blood cell that defends the body against disease organisms, also require different degrees of training.

One means by which an "educated" lymphocyte recruits and trains other lymphocytes to recognize the danger of a disease organism and start a defense against it is called "transfer factor."

This defense is "cell-mediated" and is completely different from immunity that results from the production of antibodies. Transfer factor operates at the cellular level and the agent of the transfer is a molecule.

Transfer factor, which shows great promise for treating infections and parasitic diseases, was first isolated in human beings in 1955. It has since been isolated in other animals, and zoologist Phillip H. Klesius (Regional Parasite Research Laboratory, Auburn, AL 36830), has succeeded in isolating cattle transfer factor.

It is very likely that the use of transfer factor will be successful in treating important diseases of cattle such as brucellosis and coccidiosis. The isolation of cattle transfer factor has important implications for human health as well.

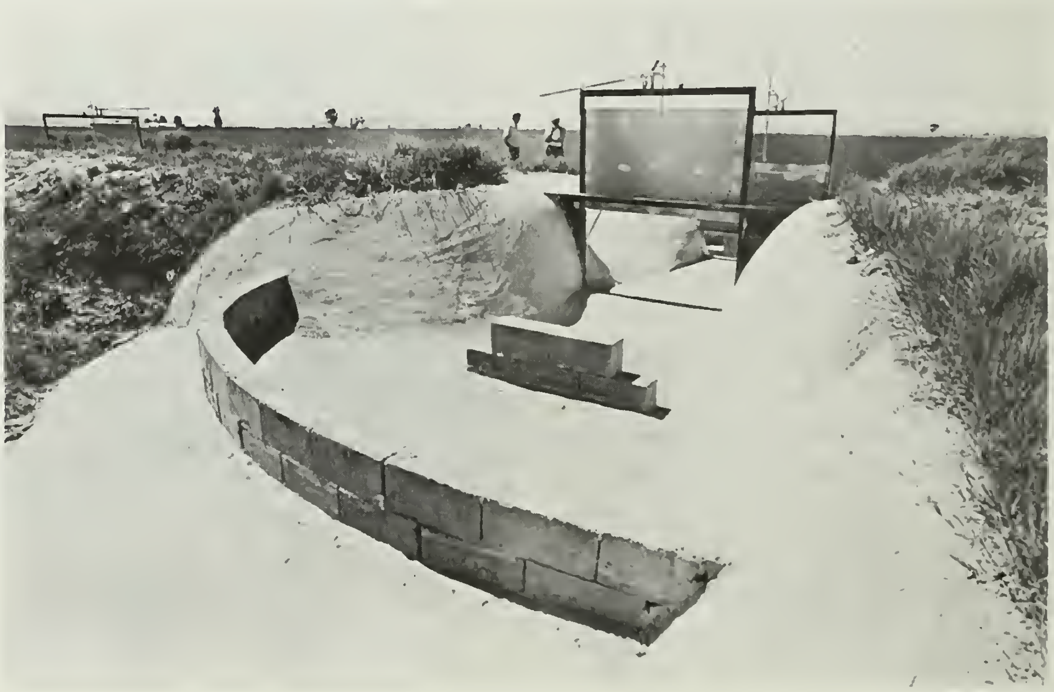
Dr. Klesius emphasizes that since the agent of transfer factor is a molecule and tissue compatibility is not a problem, transfer factor has the ability to cross species barriers. Thus, cattle-derived transfer factor could one day be used to treat human disease including cancer. Cattle transfer factor has properties comparable to human transfer factor and a cow yields large quantities of the substance.

So far in his research, Dr. Klesius has used cattle transfer factor to treat animals other than cattle including mice, rabbits, dogs, horses, and monkeys. The substance has not yet been tried on human subjects. Dr. Klesius points out, however, that cattle transfer factor is more nearly like human transfer factor than any other yet derived.

While this approach to discase control is new and experimental, the use of transfer factor shows special promise in treating diseases of cattle such as brucellosis in which the antibody defense mechanism is relatively ineffective. More broadly, future research makes transfer factor a new approach to controlling diseases of human beings.—*B.D.C.*

Right: Agricultural engineer Allen R. Dedrick inspects a jack-gate automated by a piston-type air cylinder. The jack-gates open and close on command from centrally located time clocks. This federally funded experimental jack-gate system is installed on private land; other privately funded, automated jack-gate systems have been completed or are under construction (377X342–11.) ***Below:*** *In related research, Dr. Dedrick and Mr. Erie (background) inspect an erosion control structure designed to gently dissipate irrigation water from a single jack-gate at 15 cubic feet per second or more. A cutoff wall of concrete blocks in center causes water to flow evenly over the outer ring of blocks and the concrete apron in foreground before entering the dead-level field (377X347–7).*

Irrigating on the Dead Leve



Left: Automated pneumatic pillow-type irrigation port releases water into a dead-level field. The jack-gate in background is open, allowing water to drop to the next tier or "canal" before entering outlets into field (337X343–31).
Below: Working around the clock, laser-guided earthmovers "dead level" fields to provide uniform distribution of irrigation water.
Here, four exposures on a single photograph catch laser light beamed to a receiver on a tractor-pulled scraper. The receiver intercepts the laser and holds the position of the scaper blades at the finished field elevation. Ground level tolerances come to within an inch from high to low before tillage (PN–4132).

IRRIGATORS in the Southwest are increasingly taking part in a trend that promises to improve irrigation efficiency, raise crop production, and simplify automating water distribution systems.

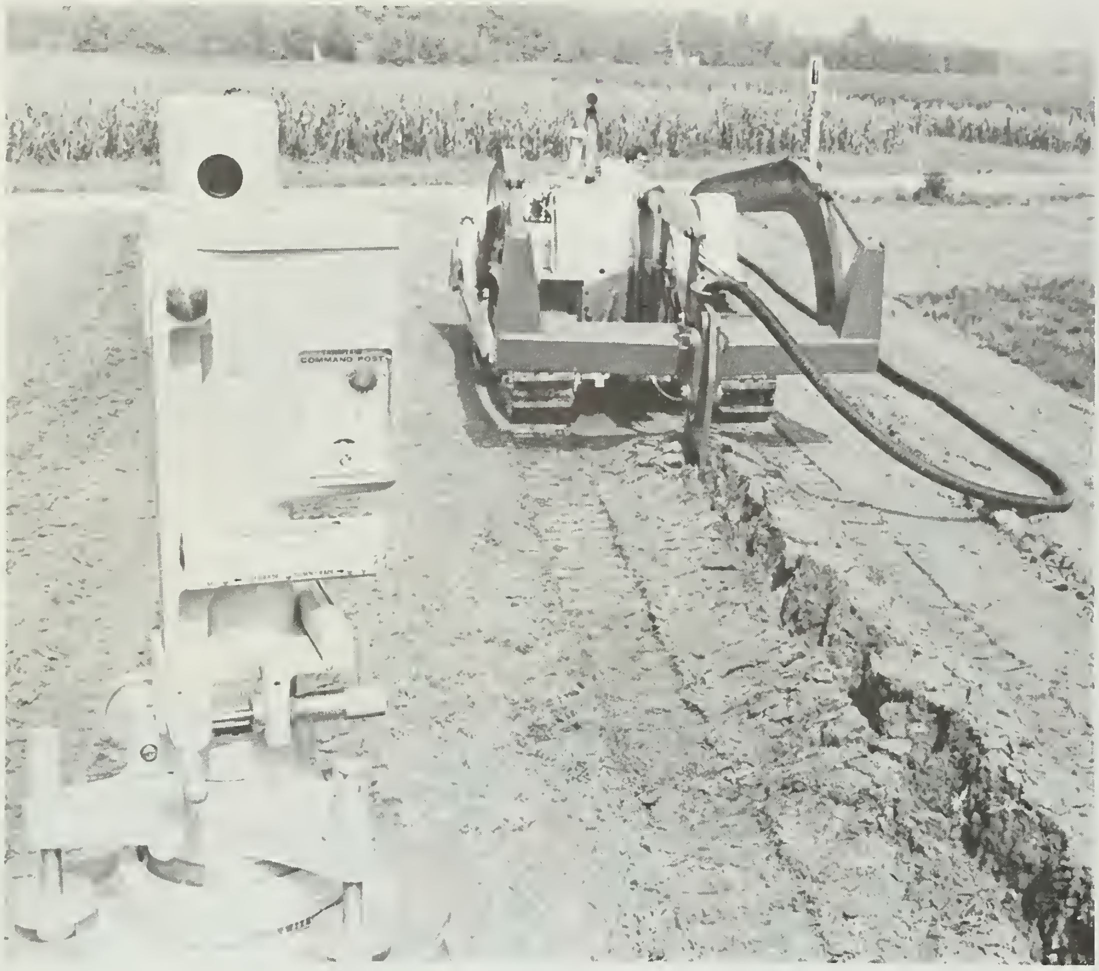
That trend is to level cropland to zero grade—dead level.

Nearly 80 percent of the Nation's irrigated lands use surface-irrigation techniques. Most of that land is slightly sloped and is irrigated using syphons or gated pipe directing water to furrows. Excess amounts of water are usually needed to get water to the farthest end of the field to equalize infiltration. That excess water is collected as drainage and contains salt picked up from the soil profile.

Automating on-farm water distribution systems is one of the measures ARS is pursuing in an overall program to reduce irrigation return flows to rivers. Return flows—drainage—contain salt picked up from irrigated fields. That salt increases the salt load already existing in the river, adding to the problems of downstream water users. Dead level fields produce no tail water (runoff at ends of furrows), thus minimizing the return flow problem. While deep percolation results from fields irrigated in excess of the evapotranspiration demand, fewer salt problems are associated with this type of irrigation.

Using two dead level fields—about 65 acres each—ARS researchers in Arizona have developed automated irrigation systems that are significant improvements over labor-intensive present-day methods.

One field, an automated jack-gate system, is the first to be actively used in the world. A significant point is that a cooperating farmer completed 15 of 18 irrigations without assistance from the researchers.



Above: ARS engineer James L. Fouss was the first person to employ a laser beam to maintain the gradeline of a mole plow when laying plastic drain tile. His work brought the laser to agriculture—and revolutionized an industry (0975X1927–7). ***Below:*** *This automated port turnout with air pillow has been in operation without malfunction for almost 2 years. Inflation or deflation of pillow causes port to open or close (377X350–9).*

More even distribution of water is a result of dead level. Mechanization should contribute to more precision in applying the exact amount of water desired.

In dead level irrigation, the idea is to get the water over the field quickly for even distribution and infiltration. The size of the stream available and the intake of the soil determines the size of the dead level basins. Smaller streams mean smaller basins. In the Wellton-Mohawk project in Arizona field sizes average about 10 acres, with stream sizes ranging from 15 to 20 cubic feet per second.

Jack-gates, so called because they are opened or closed by means of a jack-like device, are means of turning the large irrigation streams onto the field.

Another means of handling the large streams is with the use of several tile outlets embedded along the concrete-lined supply canal.

Both the jack-gates and the tile outlets have been automated as parts of the two systems by ARS agricultural engineers Leonard J. Erie and Allen R. Dedrick (U.S. Water Conservation Laboratory, 4331 East Broadway Rd., Phoenix, AZ 85040).

In the automated jack-gate system, the 65-acre block was divided into eight level basins, four each on either side of a central supply canal. Jack-gates, one for each basin, were placed at the common corner of four of these basins. A jack-gate check was placed in the canal just beyond the first set of four gates to hold the water in the canal until the first four basins were irrigated. After completion of that irrigation "set," the jack-gate check was opened and the last of the first four jack-gates was closed, allowing water to pass on to the next set of four basins.

In modifying jack-gates for automation, a piston-type air cylinder is installed in place of the gate lifting mechanism. Air lines, one a low-pressure control-signal line and the other a supply line, are buried and run to the gates from a control shed. At the gates, the

Irrigation water is released from an automated port into a dead level wheat field (377X343–22).

control line activates valves that send air to the bottom of the cylinder to open the gate, or to the top to close it.

Time clocks operate the system and are set to actuate turnouts and check gates for any predetermined length of time or gate combination. To properly operate the system as an irrigation management tool, the correct time of application must be known for each basin. Time of application is a function of basin size, size of irrigation stream, depth of application desired, and irrigation efficiency inherent in the system.

The tile-outlet system utilizes two types of air pillows to close or open the outlets. One is a pillow-type containing a valve stem and the other a bellows-type similar to air shocks found on large trucks. An air line is buried and run from a control shed to the valve stems in the "pillows."

Metal "collars" are grouted into the tile outlets in the irrigation canal to be used as a "seat" of what is essentially a 16-inch valve. Four "posts," welded equidistant around the periphery of the collar, enclose a circular metal plate and the air pillow or bellows. Pressurizing the pillow through the air line forces the metal plate against the metal collar, and the outlet is closed off. Releasing air from the pillow or bellows by bleeding the line at the control shed opens the outlet.

This system can be operated automatically from the control shed in any combination just as the jack-gate system is operated.

Safety features to take care of overflow have been programed into the system.—J.P.D.

℞ for Fragipan soils

MILLIONS OF ACRES of pastureland that is underlain with a hard, dense, and brittle layer of soil may someday be modified into productive cropland. Researchers have demonstrated the feasibility of breaking up this layer, called fragipan, while creating an improved chemical environment for root growth.

Soil scientist Joseph M. Bradford, ARS Watershed Research Unit (207 Business Loop 70 East, Columbia, MO 65201), said modification cost estimates range from $200 to $1,000 per acre. Such an investment may help establish new forests and orchards, expand vegetable crop production, or increase grain acreage.

Grain sorghum yielded 95 bushels per acre on test plots of modified Hobson soil in south-central Missouri in 1975. Dr. Bradford and soil scientist Robert W. Blanchar of the Missouri Agricultural Experiment Station, Columbia, obtained only 29 bushels per acre on control plots. The summer of 1976 was the area's driest growing season in 86 years and only the improved plots yielded any grain—26 bushels per acre.

From Oklahoma to Connecticut, some 60 million acres of fragipan soils are usually waterlogged in spring and droughty in summer. In addition to restraining water and air movement, the fragipan layer, which lies about 20 inches underground, restricts root penetration, said Dr. Bradford. Strength or hardness of the 12- to 32-inch thick layer is caused largely by chemical bonding of aluminum, iron, and silicon under acidic conditions.

Wheel trencher churns up fragipan in research aimed at modifying the hard, dense, and brittle layer of soil into productive cropland. After each vertical slice of the soil profile is mixed with lime, fertilizer, and sawdust, it is returned to the adjacent trench (PN–4136).

The treatment that the scientists found most effective for improving the soil involved digging up about 5 feet of the fragipan soil profile and mixing it with lime, fertilizer, and sawdust. "We used a wheel-type trencher to dig 20-inch-wide trenches 40 inches apart, mix the amendments with soil, and place the mixture in adjacent trenches," said Dr. Bradford.

"After treatment, soil above the old fragipan level was not waterlogged during the wet season in 1975. In refilled trenches, water easily percolated through the soil, and roots grew down to the moisture," Dr. Bradford said. These parallel trenches on the 3-percent slope served as underground terraces, storing water for plant use during the dry summers.

"We'll continue to evaluate water storage, roots' moisture uptake, and crop yields on the modified fragipan soil," said Dr. Bradford. The desirable effects of one-time modification of the Hobson soil seem likely to endure. In 1975, the scientists reexcavated and reexamined a Hobson series site where soil classification specialists of the Soil Conservation Service had dug and refilled a pit in 1959. Dr. Bradford and Dr. Blanchar saw no signs of fragipan reformation since the pit had been refilled.

Research on modifying the fragipan soil was supported in part by funds that were made available through the USDA Rural Development Act and a special assistance grant from the Missouri Agricultural Experiment Station. The study was undertaken to help community development specialists determine whether the grape industry, which prospered in the Ozark region more than a half-century ago, can be revived. The scientists grew grain sorghum instead of grapes in the early phase of the studies in order to get data quickly.—*G.B.H.*

POPULATION SIZE DOES MATTER

A 5-YEAR Polish project has verified a genetic theory previously supported only by observation and limited experiments—that effectiveness of selection increases with size of population.

Mice were the experimental animals, but the findings have broad application in livestock breeding.

The Polish scientists compared responses to selection for growth rate over 15 generations in populations of 5, 10, 25, 50, 75, and 100 pairs of parents per generation in three selected and three unselected lines of each population size. In the unselected populations, parents were chosen at random. In the selected populations the most rapidly growing individuals were chosen as parents. Mating of brother with sister was avoided.

Growth rate is defined as gain in weight from weaning to near puberty. This definition is used because genetic differences in growth can be measured most accurately during this period when both cell number and cell size are increasing rapidly, and the large differences in maternal influence are no longer involved. In mice this growth period is from 3 to 6 weeks of age, corresponding roughly to periods from 8 to 20 weeks in swine and from 6 to 12 months in cattle.

Results from the Polish study showed that increase in growth rate from 15 generations of selection was only half as large (20 percent) in small populations of 10 or 20 parents as in the larger populations of 50 to 200 parents (40 percent) even though the apparent average superiority of selected parents was similar for small and large population sizes.

The small populations were at a disadvantage because they were subject to larger random changes, either good or bad in proportion to favorable "growth" genes. Such purely chance change in the sample of genes that "happens" to be transmitted from one generation to the next limits response to the deliberate selection, because it fixes some undesired genes in the small populations before selection has time to eliminate them.

To the extent this happens genetic variation is lost before selection in small populations is able to produce its effects, and less genetic improvement results from the same apparent superiority of selected parents. Also, the greater inbreeding in the small populations may have depressed the growth rate.

Although advances in growth rate were greatest for populations of 200 parents each, response was nearly as great in populations of 50, 100, or 150 parents. Thus there was a large advantage in growth response of intermediate (50 parent) over small (20 or 10 parent) population sizes.

Rate of increase in growth has shown no signs of slowing through generation 15 in any of the population sizes. This indicates that very large numbers of genes with small individual effects control rate of growth.

The Polish project has been extended for another 5 years with several major objectives:

(1) To measure effects of population size on response to selection in crosses between lines of the same size, removing any bias from greater inbreeding depression of growth in the smaller populations;

(2) To learn whether longer term (16 to 30 generations) response from growth selection will have greater impact for very large (200 parent) than for intermediate (50 and 100 parent) populations; and

(3) To determine effects of genetic increase in growth rate on other components of performance (reproduction, food consumption, metabolic rate, mature size, lactation, and body composition) and on net life-cycle efficiency.

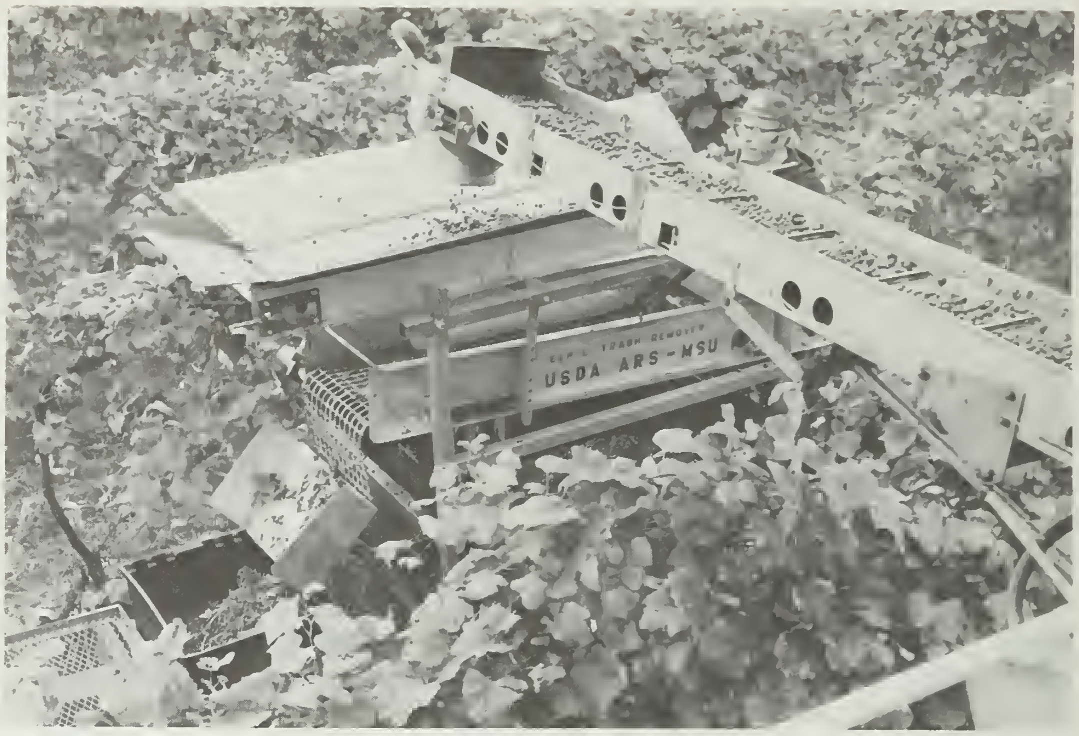
Net life-cycle efficiency is expresed in terms of "meat" production and quality—lean or fat—in ratio to total costs of parental and progeny maintenance.

Preliminary results indicate that genetic increase in growth rate may be accompanied by reduction in maintenance food required per unit of body size and by an increase in litter size. The new experiment will examine side effects of increased growth on other components of performance which determine net life-cycle efficiency.

Such information may help clarify the role of growth rate selection in livestock improvement in relation to selection for other traits such as reproductive rate, body composition, and food consumption.

Geneticist Gordon E. Dickerson (University of Nebraska, 229 Marvel Baker Hall, Lincoln NE 68583) is the ARS-cooperating scientist for these projects. Dr. Miroslaw Kownacki of the Institute of Genetics and Animal Breeding, Polish Academy of Sciences (Jastrzebiec near Warsaw) is the principal investigator.—*M.C.G.*

the Cluster Buster



Experimental trash remover in operation at down-the-row speed and over varied terrain. Mr. Marshall monitors the trial run (PN–4130).

A TRASH REMOVER with "cluster busting" capability, developed after 4 years of research, will reduce hand labor requirements for sorting trash from mechanically harvested grapes and help the industry convert to bulk handling systems.

Mechanical harvesting of grapes for processing has increased from none to about 95 percent since 1967 in the Great Lakes grape-producing area. One of the problems with mechanization has been an increase in trash—that is, leaves, petioles, and canes—harvested along with the grapes.

ARS agricultural engineer Dale E. Marshall (Agricultural Engineering Bldg., Michigan State University, East Lansing, MI 48823), developed and tested several mechanical methods for removing trash and separating the grapes from the stems. He worked in cooperation with agricultural engineers Jordan H. Levin, ARS (Retired), and Burton F. Cargill, Michigan State University, and graduate research assistant Carter Clary.

Mr. Marshall believes the experimental unit, which he tested on grapes in Michigan and Pennsylvania last fall, will do the job when it is integrated into the regular mechanical harvesting system.

The trash sorter consists of two cylindrical brushes and a vibrating coarse chain conveyor belt. Grapes and trash from the harvester are fed into the two cylindrical brushes that are rotating at different speeds. One brush turns at about 15 revolutions per minute and the other at about 200 revolutions per minute. The slower brush holds the grape clusters while the faster brush detaches grapes from the stems.

This "cluster buster" effect produces single grapes, which can be separated from the trash. From the brushes, the grapes fall to the coarse chain belt, which has holes 1¼-inch square. The grapes fall through into bulk containers as the vibrating belt moves along carrying away the petioles and other trash.

"An effective trash removal system is essential if the cost-saving bulk handling methods for grapes are to become more common. We think the trash removing unit will be small enough to be built into the mechanical harvesters," Mr. Marshall said.

Bulk handling was used for more than 10 percent of Michigan's mechanically harvested grapes in 1975. Mr. Marshall thinks 40 percent will be handled in bulk methods by 1980.

The research was funded by ARS, Michigan State University, and the Michigan and New York Grape Production Research Funds. Chisholm-Ryder Co., Inc., and Blueberry Equipment, Inc., manufacturers of grape harvesters, also cooperated in the project.—*R.G.P.*

Mr. Marshall demonstrates the "cluster busting" ability of the experimental trash remover. He holds large pieces of trash from the bin on his right (PN–4131).

Longer storage for dried fruits

DRYING is an economical way to store fruits. Energy is not required to keep them cold or frozen. Moreover, their reduced weight—only 10 to 35 percent of fresh or canned fruits—reduces shipping costs.

However, long-term storage can cause dried fruits to darken, decreasing their marketability. Darkening occurs more readily in cut fruits as their sulfur dioxide (SO_2) is lost.

ARS chemists Harold R. Bolin and Allan E. Stafford of the Western Regional Research Center (800 Buchanan Street, Berkeley, CA 94710) have extended storage times for dried peaches from an average of 13 months using current methods to as long as 18 months with improved packaging and handling techniques.

They knew from previous research that high temperature was the major cause of fruit darkening but conducted additional studies on how the type of packaging and sealed-in environments affected storage.

The researchers tested dried peaches under a combination of packaging materials, from waxed cartons to the newest cellophanes and polyethylene pouches, and sealed-in environments. These environments included vacuums, regular air, and nitrogen (N).

The longest storage times (up to 18 months) resulted when dried peaches were sealed in polyethylene pouches and held at 21° C (approximately 69° F). Before sealing, pouches were subjected to a vacuum, drawing out nearly all the air. The vacuum was released with N gas, allowing it to seep in. The nitrogen environment retarded loss of SO_2 from the fruit.

Although the tests were conducted using only dried peaches, the chemists believe similar results can be achieved with other cut fruits.

Dried peaches are either eaten directly from the package or used in cooking or baking. The United States processes about 2,000 tons of dried peaches annually.—*D.H.S.*

Mixing strains offers control

AN INABILITY of different strains of almond moth to mate and reproduce is being explored as a possible means of controlling insect populations, particularly those insects that infest stored food and feed products.

Entomologist John H. Brower (Stored-Products Insects Research and Development Laboratory, P.O. Box 5125, Savannah, GA 31403) discovered that Iranian female almond moths were incompatible with males from both laboratory and field strains from the United States.

In crosses of Iranian females with U.S. males, matings and oviposition were normal but the eggs were almost all infertile. In contrast, reciprocal crosses were normal in egg fertility. Thus, the incompatibility was only one way.

This type of reproductive incompatibility could likely be used to suppress natural populations by releasing large numbers of incompatible males that are both healthy and competitive for mates, but which are effectively sterile.

Dr. Brower is quick to point out that the idea is not suggested for control of insect populations in large geographic areas, but rather in small confined or isolated areas such as warehouses. He reasons that it would be difficult for field operations because only the males could be released. To release females as well as males results in the alien strain replacing the domestic strain.—*V.R.B.*

For cattle only

KLEINGRASS is a fine grass—but for cattle only. The grass, which was introduced from Africa and has found good acceptance in Texas for about 10 years, makes lambs hypersensitive to sunlight, a condition called "photosensitization."

"Swell Head," the common name for the ailment, results from liver damage caused by a poison in the grass. The heads of lambs swell, the skin around the muzzle and on the ear blisters and peels, and the eyes become yellow. The poison causes internal lesions as well, and if the lambs are not removed from the sunlight and properly fed and watered, they will die. One rancher lost 50 out of 200 sheep that had grazed the grass.

Cattle are apparently not affected by the poison in Kleingrass, a warm season perennial bunchgrass. About one-half million acres of this fine-stemmed leafy grass has been established in Texas. It is very palatable both as green forage and cured hay, and cattle performance on it has been better than average for warm-season perennial grasses.

But, according to ARS veterinary medical officer James W. Dollahite (Veterinary Toxicology and Entomology Research Laboratory, College Station, TX 77840) who led a research team that studied the problem, Kleingrass will have to be reserved for cattle and possibly mature sheep.—*B.D.C.*

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Peanuts for protein

PEANUT PROTEIN FLOURS have properties that may make them more desirable for food supplements than soybean protein flours.

Peanut flours have a bland flavor and contain a very low concentration of flatulence-producing sugars while soybean flours generally have an objectionable beany flavor and are rather rich in flatulence-producing carbohydrates.

In studies conducted at the Southern Regional Research Center (P.O. Box 19687, New Orleans, LA 70179), chemists Edith J. Conkerton and Robert L. Ory carefully analyzed and compared proteins from three peanut cultivars, Virginia and red-skin and white-skin Spanish, as potential protein supplements for foods.

From the data gathered in the study, Mrs. Conkerton and Dr. Ory have determined that because of similarities in composition, potential uses would not be limited to one type or variety of peanut.

Interestingly, the white-skin peanut, which is not grown commercially because it lacks flavor, appears to have more potential as a source of oilseed protein because of its white skin. Since the skins have no color the blanching, or skin removal, step in processing can be eliminated to save 2 to 4 cents per pound. Also, the calcium content of this flour is considerably higher then red-skin peanut flours.

Peanut flours have been used experimentally (1 percent) in pineapple juice to triple the protein content, as a meat extender (42 percent) and in bread (15 percent). All of the products containing peanut flour were considered acceptable when compared with the conventional products.—*V.R.B.*

Alternating the moisture regime

ALTERNATING irrigated with dryland wheat will increase yields about 10 percent over continuously irrigated and dryland wheat on the same field.

In other words, rather than dividing an area and growing irrigated wheat on one portion and dryland wheat on the other year after year, the 10-percent gain will come from alternating the irrigated portions with the dry.

Soil scientist Paul Unger (USDA Southwestern Great Plains Research Center, Bushland, TX 79012) conducted a 4-year study with the prior knowledge that some water remained in the soil after irrigated wheat was harvested. Some of this water will percolate out of the root zone unless it is utilized by a dryland crop.

Dr. Unger found that the average yield for continuous dryland and irrigated wheat grown on separate areas was 47 bushels per acre. However, where dryland and irrigated wheat were alternated, yield increased to 52 bushels per acre.

The amount of water used in each system was equal.

"Farmers with more land than water," says Dr. Unger, "will definitely benefit by alternating irrigated with dryland wheat."—*B.D.C.*

When reporting research involving pesticides, this magazine does not imply that pesticide uses discussed have been registered. Registration is necessary before recommendation. Pesticides can be injurious to humans, domestic animals, desirable plants, and fish or other wildlife—if not handled or applied properly. Use all pesticides selectively and carefully.

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